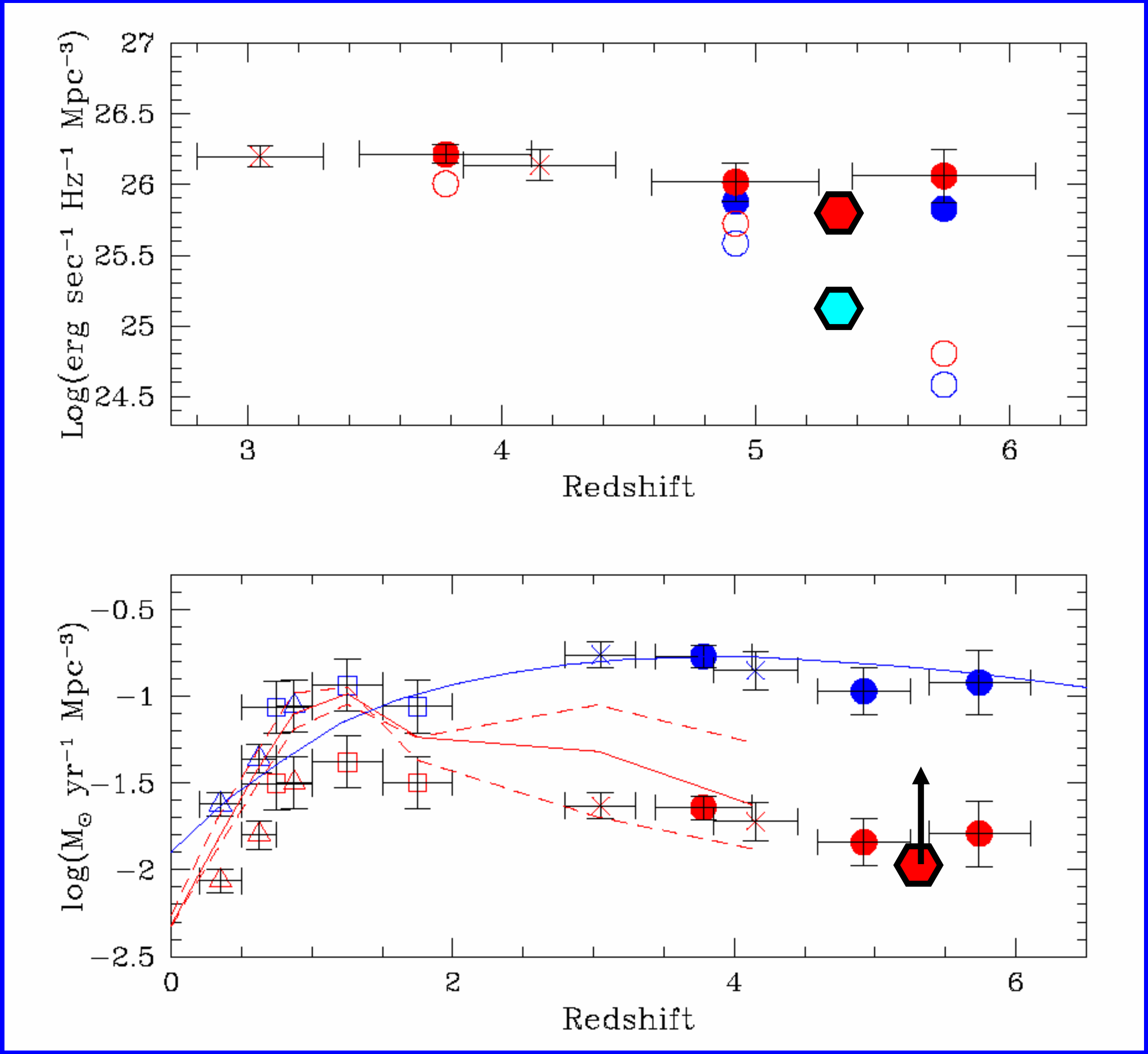
Star-formation “history”

Comoving ρ_{UV} and SFR at high redshift:



Giavalisco et al. (2003)

Frankly, the star-formation history is not very constraining … can be fit with almost any type of model.

Dynamics of High-z Galaxies

We have no coherent model for the growth of baryons in galaxies! Why not?

- Inherently non-linear problem over a wide range of scales which is influenced by the initial conditions (which are going to eventually be tightly constrained), feedback from star-formation, efficiency of star-formation, environmental effects, etc. Highly stochastic.

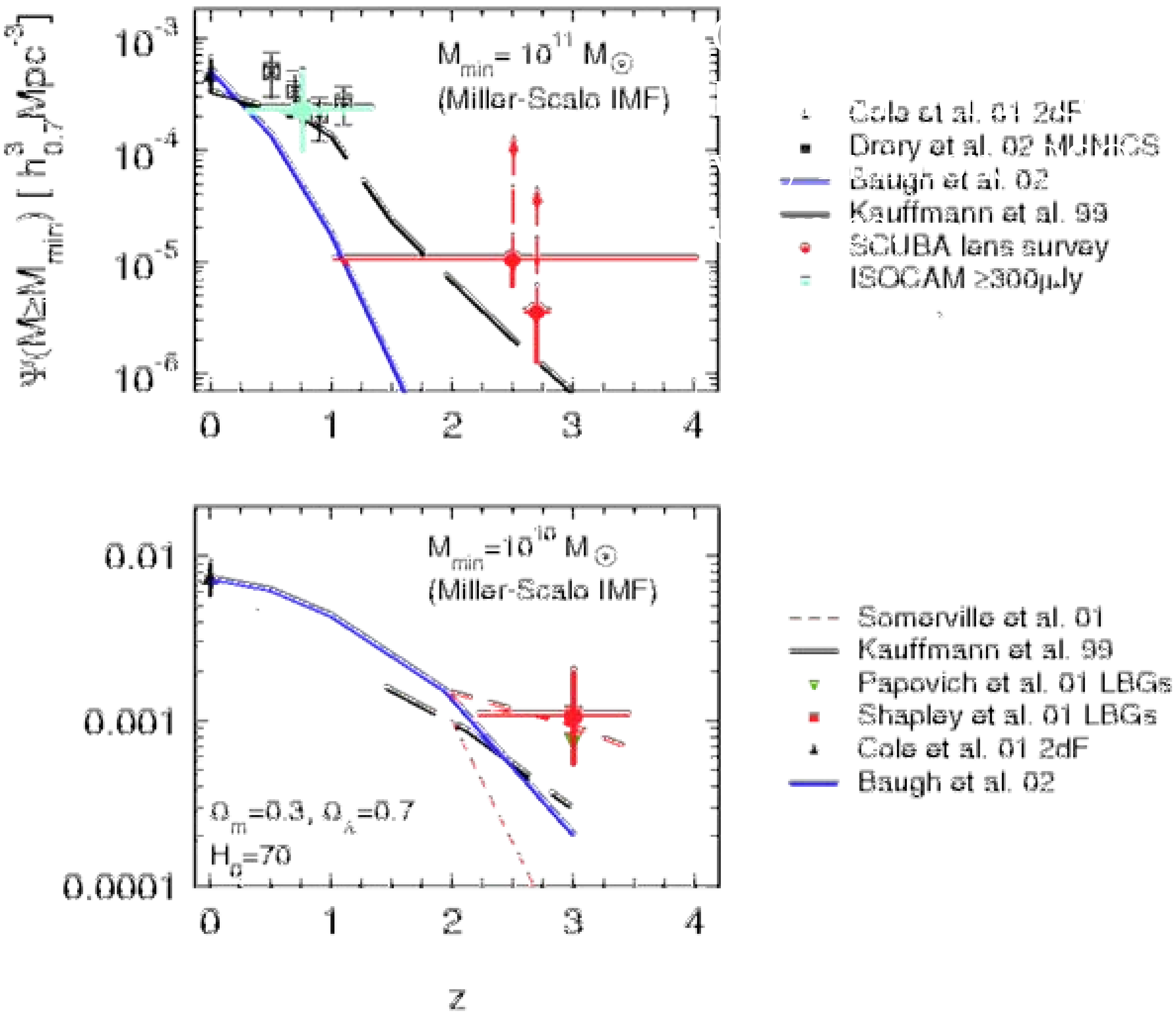
- This means models would have very little direct predictive power with specific sets of initial conditions, but would only constrain the ranges over which these influences can vary. So like other highly non-linear stochastic problems, will only reduce down to a set of characteristic numbers (similar to Reynold's number in fluid dynamics).

Dynamics of High-z Galaxies

It is easily possible for ΛCDM to get 0^{th} order quantities like the total baryonic masses or DM masses correct but still be wrong (quantity over quality).

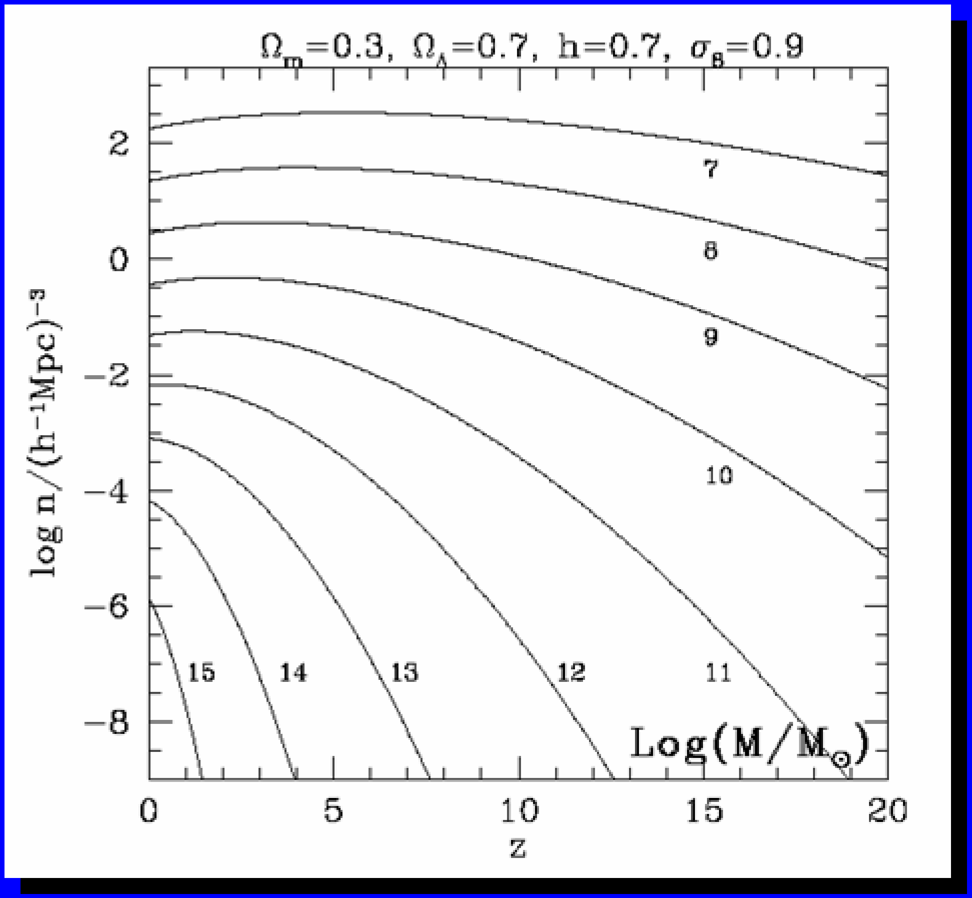
Becoming very clear that baryons collapsed much earlier than the simple models predict – especially for the massive systems (too many massive galaxies, too many old galaxies, total metal abundances too low, ratio of metals all wrong).

Early Baryon Collapse



Genzel et al. (2002)

Not a problem with ΛCDM ?



Mo and White (2002)

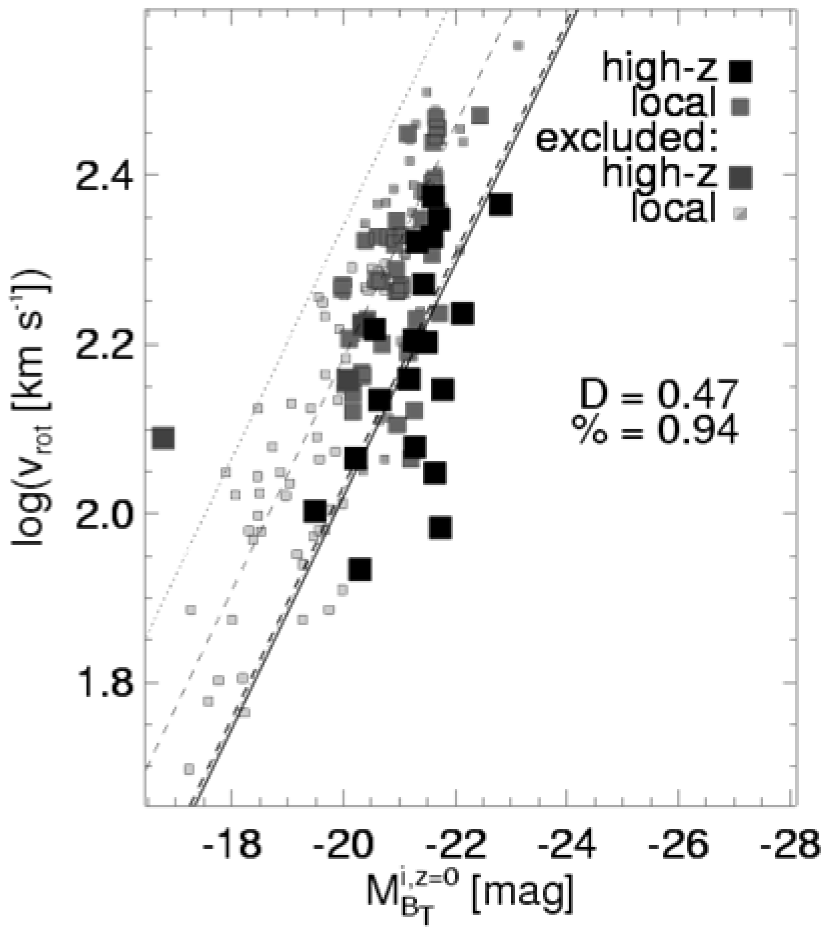
Plenty of massive DM halos at high redshift – we just don't have much of a clue how they filled with baryons.

Dynamics of High-z Galaxies

Given the complexity, must get beyond 0^{th} quantities (masses and sizes) and 1^{st} order quantities such as:

- the spatial distribution of star-formation and gas phase metallicity,
- SFR $\propto$ α t_{dyn}
- angular momenta of disks and its distribution,
- feedback,
- ratio of dark to baryonic matter as a function of radius,
- total dark matter content, etc.

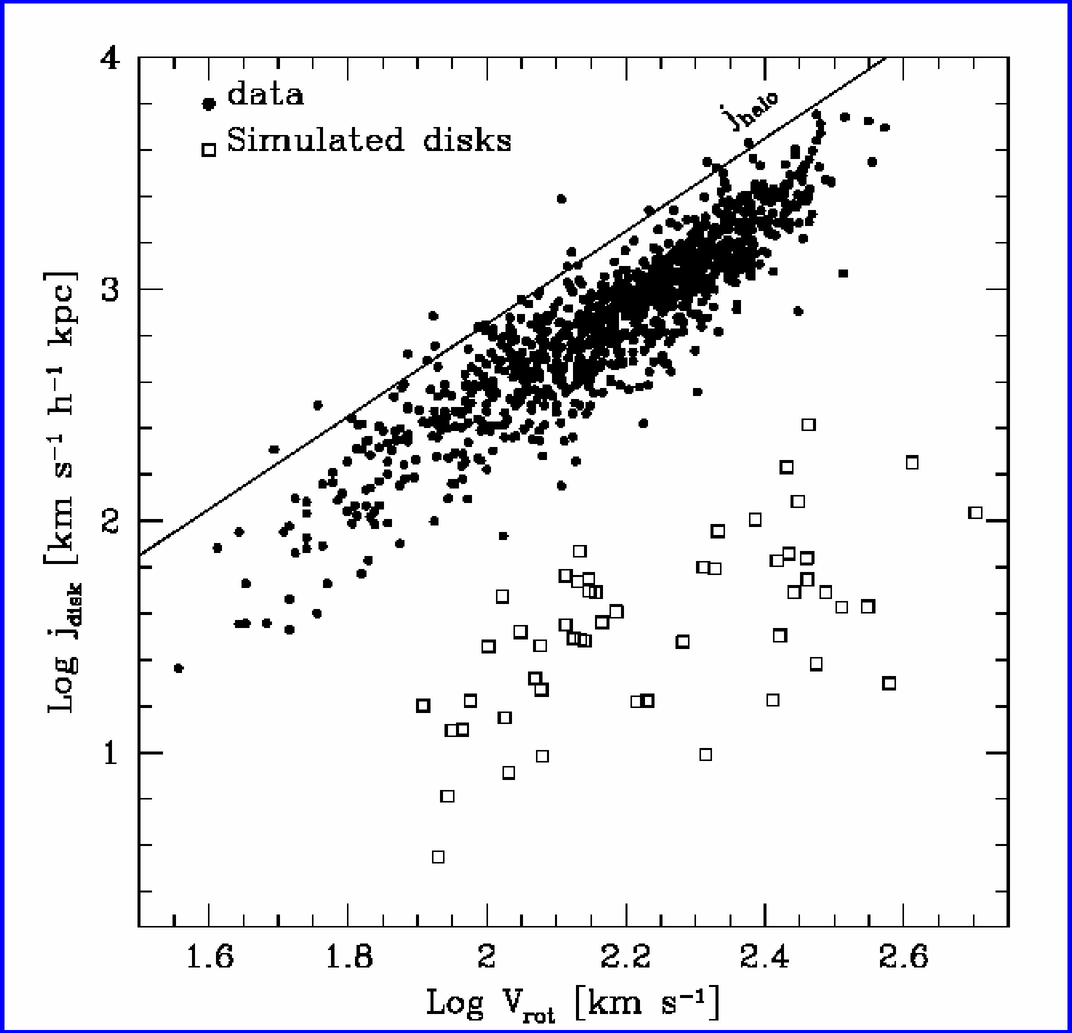
Tully-Fisher Evolution



Barden et al. (2003)

Offset of about a magnitude in the rest-frame B-band at <z>≈1.0. Near-IR study using Hα.

Angular momentum problem

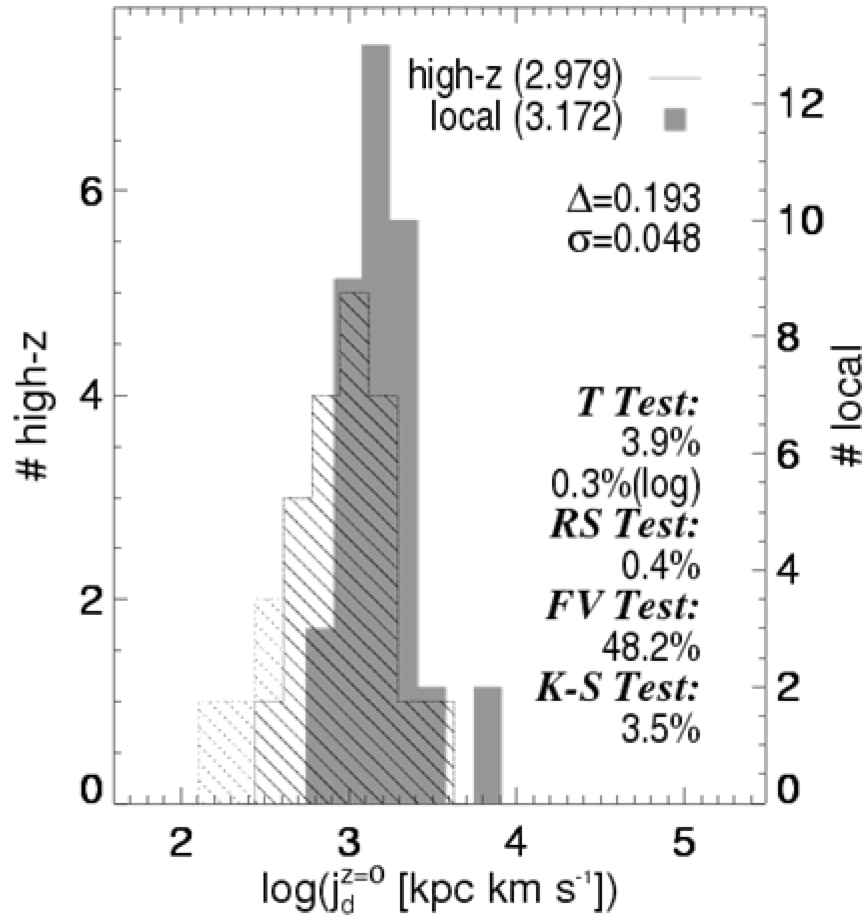


Steinmetz and Navarro (2000)

SPH plus N-body cannot predict the total angular momentum even if they include feedback.

Need angular momentum of halo and baryons to be roughly the same which is difficult to do and difficult to understand.

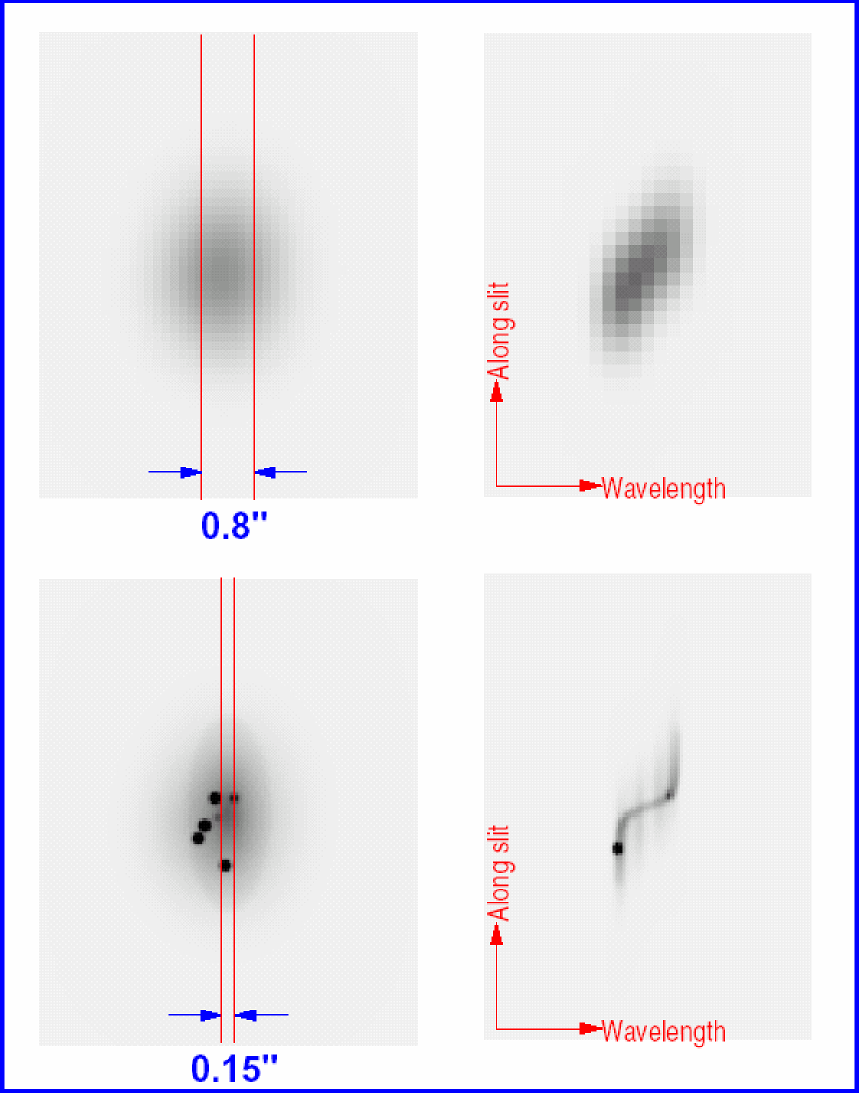
Angular momentum problem



Barden et al. (2003)

Can't predict correct amount and do not get correct evolution of angular momentum either.

Technology Needed



Koo (2000)

Need high strehl ratios over a wide field of few arc minutes. Down to K=21, there are a few per sq arc minute over interesting redshifts.

Need multi positionable near-infrared IFUs with pixels sizes that roughly match the size of the line emitting regions and not necessarily the diffraction limit of the telescope.

This is a detection experiment of the most extended gas and is surface brightness limited, not necessarily resolution limited.

Ridiculous suggestion

Map out the distribution and dynamics of low luminosity companion galaxies. This would allow us to map out (statistically) the development of total mass and baryonic to dark matter out to redshifts of about 5 ([OII] falls out of K-band).

- need to detect all of the line emitters down to SMC like luminosities,
- distribution of continuum only emitting objects, and perhaps use photometric techniques to argue they are companions,
- estimate the baryonic growth directly,
- estimate the dynamical masses statistically,
- compare as a function of baryonic mass (classical rotation curves),
- see how these parameters change with redshift.